

Study of Artificial Intelligence Methods and Systems in Renewable Energy for Iraq: A Review

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Abstract:

Artificial intelligence is transforming the energy sector by enhancing the efficiency, reliability, and sustainability of renewable energy systems such as solar, wind, and hydropower. AI tools such as machine learning and predictive analytics address challenges such as unpredictability and intermittency of these sources, improve energy management, and support smart grid integration. As countries like Iraq seek to develop sustainable energy infrastructure, AI provides an opportunity to optimize the use of renewable resources, reduce dependence on fossil fuels, and enhance energy distribution for economic and environmental benefits. Iraq, known for its oil reserves, is working to diversify its energy sources. The renewable energy potential in Iraq is significant, given its favorable conditions for solar and wind energy. Government policies and international investments are driving advances in renewable technologies. Solar, wind, and hydropower are contributing to this diversification, with the goal of enhancing energy security, creating jobs, and addressing environmental issues for Iraq's long-term stability and international climate commitments. AI technologies such as machine learning, neural networks, and fuzzy logic are providing new ways to increase the efficiency of renewable energy systems. These technologies predict energy production, improve energy resource scheduling, handle complex data sets, and optimize system design and operation. These innovations are critical to sustainable development in Iraq, enhancing energy access and contributing to a more resilient grid. AI applications are emerging in Iraq's energy sector, with initiatives such as predictive analytics for solar power improving production and cost efficiency. AI is also helping wind energy projects by optimizing turbine operations and integrating renewable energy sources into the grid, increasing stability and resilience. However, Iraq faces challenges such as aging infrastructure and a lack of skilled professionals, which hinder the deployment of AI. Overcoming these issues involves training, education, and upgrading infrastructure. Despite the challenges, AI creates opportunities for optimization and efficient use of resources and improved maintenance, thus contributing to sustainability and economic growth. The future of AI in Iraq's renewable energy industry is promising, and depends on strategic implementation and investment. For successful integration, the country requires strong regulatory frameworks, collaboration with international companies, and development of local expertise through education. Such measures would ensure the ability to adapt to local conditions, helping Iraq achieve sustainable development goals and drive the renewable energy sector forward.